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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/544,271	YOO ET AL.	
	Examiner	Art Unit	
	Jay C. Kim	2815	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *01 November 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-9,11 and 13-15* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *7-9 and 13-15* is/are allowed.

6)☒ Claim(s) *1-6 and 11* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

This Office Action is in response to the amendment filed November 1, 2007.

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claim 11 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Examiner finds it unclear how the n-type $Si_aC_bN_c$ recited in claim 7 can also have a p-type conductivity recited in claim 11.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nobuyuki et al. (Machine translation of JP H10-084159) as modified by Edmond et al. (US 5,338,944) and further in view of Sung et al. (US 2002/0179918).

Regarding claims 1, 4 and 6, Nobuyuki et al. disclose a III-nitride semiconductor light emitting device (Fig. 1) comprising a plurality of III-nitride semiconductor layers

(layers 102-108) including an active layer (105) (lines 1-2 of [0019]) inherently emitting light by recombination of electrons and holes, the plurality of III-nitride semiconductor layers (layers 102-108) having a p-type III-nitride semiconductor layer (108) (lines 4-5 of [0021]) at the top thereof, a SiC layer (109) (lines 1-2 of [0023]) grown on the p-type III-nitride semiconductor layer (108), the SiC layer (109) having a p-type conductivity and a thickness of 1,000 Å (lines 1-2 of [0023]), and a p-side electrode made of nickel and gold (113 and 114 combined) (lines 2-3 of [0028]) formed on the SiC layer (109).

Nobuyuki et al. differ from the claimed invention by not comprising the SiC layer having an n-type conductivity and a thickness of 5 to 500 Å for the holes to be injected into the p-type III-nitride semiconductor layer by tunneling.

Edmond et al. disclose a SiC semiconductor light emitting device (Fig. 3) comprising a top SiC contact layer (56) having an n-type conductivity (col. 6, lines 67-68 and col. 7, lines 6-8) to take advantage of greater conductivity and optical characteristics of n-type SiC layer (col. 7, lines 10-12).

Since both Nobuyuki et al. and Edmond et al. teach a semiconductor light emitting device comprising a SiC substrate and a SiC p-side contact layer, it would have been obvious to the one of ordinary skill in the art at the time the invention was made to combine the III-nitride semiconductor light emitting device disclosed by Nobuyuki et al. with the n-type p-side SiC contact layer disclosed by Edmond et al., because the n-type p-side SiC contact layer would have greater conductivity and better optical characteristics, and easier to form than p-type p-side SiC contact layer (col. 7, lines 12-16 in Edmond et al.).

Further regarding claim 1, Nobuyuki et al. as modified by Edmond et al. differ from the claimed invention by not comprising the SiC layer having a thickness of 5 to 500 Å for the holes to be injected into the p-type III-nitride semiconductor layer by tunneling.

Sung et al. disclose a III-nitride semiconductor light emitting device (Fig. 1) where the thickness of the n-type p-side contact layer (20) (lines 13-14 of [0011]) is 20 Å (lines 2-4 of [0013]) for the holes to be injected into the p-type III-nitride semiconductor layer (16) by tunneling, which is reverse-tunneling.

Since both Nobuyuki et al. and Sung et al. teach a III-nitride semiconductor light emitting device, it would have been obvious to the one of ordinary skill in the art at the time the invention was made to combine the III-nitride semiconductor light emitting device disclosed by Nobuyuki et al. as modified by Edmond et al. with the thickness of the contact layer disclosed by Sung et al., because the thickness of the contact layer can be controlled to optimize reverse-tunneling to improve the performance of the III-nitride semiconductor light emitting device.

Further regarding claim 1, the claim is prima facie obvious without showing that the claimed range achieves unexpected results relative to the prior art range. In re Woodruff, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also In re Huang, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996) (claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also In re Boesch, 205 USPQ 215 (CCPA) (discovery of optimum

value of result effective variable in known process is ordinarily within skill of art) and In re Aller, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art general conditions is obvious).

Regarding claim 2, Nobuyuki et al. as modified by Edmond et al. and further in view of Sung et al. differ from the claimed invention by not showing that the doping concentration of the SiC layer is in a range from 1×10^{18} to 1×10^{22} atoms/cm^3.

Edmond et al. further disclose that in another embodiment of a SiC semiconductor light emitting device (Fig. 1), the doping concentration of the top SiC contact layer (23) (col. 5, line 11) is greater than 1×10^{19} atoms/cm^3 (col. 6, lines 54-56).

Since both Nobuyuki et al. and Edmond et al. teach a semiconductor light emitting device comprising a SiC substrate and a SiC p-side contact layer, it would have been obvious to the one of ordinary skill in the art at the time the invention was made to combine the III-nitride semiconductor light emitting device disclosed by Nobuyuki et al. as modified by Edmond et al. and further in view of Sung et al. with the n-type doping concentration of the p-side SiC contact layer disclosed by Edmond et al., because the doping concentration of the contact layer can be controlled to improve the performance of the III-nitride semiconductor light emitting device.

Regarding claim 3, Nobuyuki et al. as modified by Edmond et al. and further in view of Sung et al. differ from the claimed invention by not showing that the growth temperature of the SiC layer is in a range from 600 °C to 1200 °C.

The limitation "the growth temperature of the SiC layer is in a range from 600 °C to 1200 °C" is a product-by-process limitation that does not structurally distinguish the claimed invention over the prior art. Note that a product by process claim is directed to the product per se, no matter how actually made, In re Hirao, 190 USPQ 15 at 17 (footnote 3). See also In re Brown, 173 USPQ 685; In re Luck, 177 USPQ 523; In re Fessmann, 180 USPQ 324; In re Avery, 186 USPQ 161; In re Wertheim, 191 USPQ 90 (209 USPQ 554 does not deal with this issue); and In re Marosi et al, 218 USPQ 289, all of which make it clear that it is the patentability of the final product per se which must be determined in a product by process claim, and not the patentability of the process, and that an old or obvious product by a new method is not patentable as a product, whether claimed in product by process claims or not. Note that applicant has the burden of proof in such cases, as the above case law makes clear.

Regarding claim 5, Nobuyuki et al. as modified by Edmond et al. and further in view of Sung et al. differ from the claimed invention by not showing that the p-side electrode is made of ITO (Indium Tin Oxide).

Sung et al. further disclose that the p-side electrode (17) (lines 5-6 of [0012]) is made of ITO (lines 1-4 of [0015]).

Since both Nobuyuki et al. and Sung et al. teach a III-nitride semiconductor light emitting device, it would have been obvious to the one of ordinary skill in the art at the time the invention was made to combine the III-nitride semiconductor light emitting device disclosed by Nobuyuki et al. as modified by Edmond et al. and further in view of

Sung et al. with the p-side electrode of ITO disclosed by Sung et al., because ITO is a well-known electrode material for a III-nitride semiconductor light emitting device.

Allowable Subject Matter

5. Claims 7-9 and 13-15 are allowed.

Regarding claim 7, Nobuyuki et al. (JP H10-084159) as modified by Nishi et al. (US 2003/0111666) as evidenced by Shi et al. (US 6,130,001) disclose a III-nitride semiconductor light emitting device comprising a plurality of III-nitride semiconductor layers including an active layer emitting light by recombination of electrons and holes, the plurality of III-nitride semiconductor layers having a p-type III-nitride semiconductor layer at the top thereof, a CN layer grown on the p-type III-nitride semiconductor layer, and a p-side electrode formed on the CN layer. However, Nobuyuki et al. as modified by Nishi et al. as evidenced by Shi et al. do not disclose that the CN layer has an n-type conductivity and a thickness of 5 to 500 Å.

Response to Arguments

3. Applicants' arguments filed November 1, 2007 have been fully considered but they are not persuasive.

Applicants argue that "Edmond et al. discloses not the SiC layer having an n-type conductivity and a thickness of 5 to 500 Å for the holes to be injected into the p-type III-nitride semiconductor by tunneling recited in Claim 1, but the "degenerate junction structure 52" in Fig. 3 of Edmond et al., which consists of an n-type layer 56 and a p-

type layer 57". Edmond et al. disclose a p-side SiC contact layer having an n-type conductivity and Edmond et al. in view of Sung et al. disclose the thickness of the SiC layer of 5 to 500 Å, and the limitation "for the holes to be injected into the p-type III-nitride semiconductor by tunneling" specifies an intended use or field of use of the SiC contact layer.

Applicants argue that "as such, even the combined LED structure taught by Nobuyuki et al. and Edmond et al. does not teach or suggest the LED structure recited in Claim 1 of the present invention", and that "further, neither Nobuyuki et al. nor Edmond et al. teaches or suggests why the p-type SiC capping layer disclosed in Nobuyuki et al. is replaced with only the n-type SiC layer 56 of in Fig. 3 of the degenerate junction structure disclosed by Edmond et al." As stated in the rejection of claim 1, Nobuyuki et al. as modified by Edmond et al. and further in view of Sung et al. disclose all the limitations of claim 1. Examiner did not suggest that the p-type SiC capping layer 109 disclosed by Nobuyuki et al. is replaced with only the n-type SiC layer 56 disclosed by Edmond et al., but suggested that the n-type SiC layer 56 disclosed by Edmond et al. can be formed on the p-type SiC contact layer 109 disclosed by Nobuyuki et al. to make a p-side contact layer structure similar to the composite layer of 57 and 56 disclosed by Edmond et al.

Conclusion

4. **THIS ACTION IS MADE FINAL.** Applicants are reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jay C. Kim whose telephone number is (571) 270-1620. The examiner can normally be reached on 7:30 AM - 5:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kenneth Parker can be reached on (571) 272-2298. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

J. K.
January 18, 2008

Matthew C. Landau
Primary Examiner